UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P O Box 1450
Alexandria, Virginia 22313-1450
www uspto gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/780,025	02/17/2004	Wenbin Gu	8540G-000187	9272

27572 7590 12/02/2009
HARNESS, DICKEY & PIERCE, P.L.C.
P.O. BOX 828
BLOOMFIELD HILLS, MI 48303

EXAMINER	
WALKER, KEITH D	

ART UNIT	PAPER NUMBER
1795	

MAIL DATE	DELIVERY MODE
12/02/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/780,025	GU ET AL.	
	Examiner	Art Unit	
	KEITH WALKER	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 July 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,5,7-23,51,53,55-66 and 68-75* is/are pending in the application.

4a) Of the above claim(s) *13 and 14* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,5,7-12,15-23,51,53,55-66 and 68-75* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114 was filed in this application after appeal to the Board of Patent Appeals and Interferences, but prior to a decision on the appeal. Since this application is eligible for continued examination under 37 CFR 1.114 and the fee set forth in 37 CFR 1.17(e) has been timely paid, the appeal has been withdrawn pursuant to 37 CFR 1.114 and prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on 3/18/09 has been entered.

Response to Amendment

Claims 75 is new and claims 1, 2, 5, 7-23, 51, 53, 55-66 & 68-75 are pending in the application with claims 13 & 14 withdrawn for being drawn to a non-elected invention.

Claims 1, 2, 5, 7-12, 15-23, 51, 53, 55-66 & 68-75 are pending examination as discussed below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1, 2, 5, 7-12, 15-21, 23, 51, 53, 55-66 & 68-75 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Publication 2003/0235735 (Miyazawa) in view of US Patent 5,432,023 (Yamada).

Miyazawa teaches an electrochemical cell having: a membrane electrode assembly (MEA) comprising an anode and cathode (Figure 1, #20); an electroconductive element comprising an impermeable electrically conductive element (ECE) having a major surface facing the cathode (Figure 1, #4b) and a porous liquid distribution media (LDM) disposed along the major surface defining flow channels for transporting gas and liquid to and from the cathode (Figure 2, #14). An electrically conductive fluid distribution layer (FDL) is disposed between the liquid distribution media and the cathode for transporting gases and liquids between the cathode and the flow channels (Figure 1, #21b). The FDL and LDM are constructed and arranged to transport liquids accumulating within the cathode through the FDL to the LDM. The ECE and LDM are arranged together to define the flow channels. The LDM forms an electrically conductive path between the ECE and FDL. The LDM is more hydrophilic than the FDL, overlies substantially the entire major surface of the ECE, and is disposed in regions along the major surface defining separate spaced-apart flow channels. The LDM has an undulated configuration of peaks and valleys and internally redistributes liquid water. The electroconductive element also comprises a second ECE having a second surface facing the anode, a second LDM along regions of the second surface, and a second FDL disposed between the electroconductive element and anode and in contact with the second LDM. The LDM is composed of a conductive hydrophilic

material, for example carbon black. The porous fluid distribution layer (FDL) is in physical contact and fluid communication with an electrode and the porous LDM layer is more hydrophilic than the FDL and draws water from the electrode through the FDL. Miyazawa teaches coating an electrically conductive hydrophilic layer on the electrically conductive separator ([0036]). The hydrophilic layer is then removed from the very top surface of the separator's protrusions so the hydrophilic layer is left on the sidewalls and bottom surface of the separator (Fig. 2). When this top layer is removed, the edge portion of the hydrophilic layer on the sidewalls is even with the top surface of the separator. When the fuel cell is assembled and the gas distribution layer (appellant's FDL) is set on top of the separator, this edge portion of the hydrophilic layer on the sidewall will contact the FDL, thereby making both a fluid and electrical connection. ([0018–0029], [0033-0037], [0038-0042], [0056], [0057]).

Miyazawa is silent to the size of the pores for the fluid distribution layer and the liquid distribution layer.

Yamada also teaches a fuel cell system with an impermeable metal separator and layers of conductive porous material with differing pore sizes (10:40-60, 16:25-40). Having materials with two different pore sizes pulls the liquid in the direction of the smaller pores. By varying the pore diameter, the rate or force with which the liquids are drawn in the direction of decreasing pore diameter can be changed. With respect to the cathode, the conductive porous material next to the cathode will have a pore diameter larger than the porous material next to the separator so the water is pulled away from the cathode (39:2-27). The pore sizes dictate what liquid or gas is passed through the

structure and which direction the liquid or gas passes (24:14-20, 39:5-10). The size of the pores is dependent on the material used as the porous layer and the type of fluid to be transported by the pores. Yamada teaches pore sizes of 30 microns and a formula, such that the pore sizes can be varied to optimize factors such as the fluid travel speed and the fluid volume transported (39:15-50). A nickel mesh is used for the conductive material (47:35-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the porous layers of Miyazawa with the pore size structures taught by Yamada to improve the efficiency of the fuel cell by pulling the by-product waste, such as water, away from the electrodes to produce a more efficient fuel cell. The pore sizes can be adjusted for the material used, the application and the force with which the fluid will be withdrawn from the electrode material by applying the formula taught (39:30-40).

Regarding claims 17, 19, 21, 23, 59, 61, 63, 71, 73 & 74 these claims are product-by-process limitations and even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. "The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process" (MPEP 2113). While these limitations have been considered, they have not been given patentable weight. The final product as taught by Miyazawa and Yamada as discussed above is obvious over the product of the instant application. The

method of forming the device is not germane to the issue of patentability of the device itself. Furthermore, the processes of spraying, coating, casting and sintering to form liquid distribution media and other fuel cell components are all well-known to one of ordinary skill in the art. Combining prior art elements according to known methods to yield predictable results and using known techniques to improve similar devices in the same way are considered obvious to one of ordinary skill in the art (KSR, MPEP 2141 (III)).

2. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Miyazawa et al. (US 2003/0235735) and US Patent 5,432,023 (Yamada), as applied to claim 1 above, further in view of Davis (US 2002/0001743).

Miyazawa and Yamada teach the elements of claim 1 as discussed above but fail to teach the impermeable electrically conductive element formed of aluminum, titanium, stainless steel, or alloys or mixtures thereof.

Davis teaches that forming bipolar plates using metals with high electrical and thermal conductivity, such as Al, Cu, and Ti, results in plates with electrical conductivity 500 times better and thermal conductivity double that of graphite. This can reduce the effect of localized heating due to areas of localized high current density and voltage drop, such as membrane dry-out (Page 2, [0007], [0008]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made would have used a bipolar plate made of Al or Ti as taught by Davis in the electrochemical cell as taught by Miyazawa and Yamada in order to

reduce localized heating caused by areas of high current density and large voltage drop.

Response to Arguments

Applicant's arguments filed have been fully considered but they are not persuasive.

Concerning all the arguments presented by appellant, appellant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Applicant argues Miyazawa teaches away from the claimed invention since it "prohibits the hydrophilic membrane 14 from contacting electrodes", citing paragraph [0033] of the reference. However, this statement is not taught by the reference. The reference only teaches removing the hydrophilic membrane 14 from the surface of the land, not that it "prohibits the hydrophilic membrane from contacting the electrodes." Miyazawa teaches coating an electrically conductive hydrophilic layer on the electrically conductive separator ([0036]). The hydrophilic layer is then removed from the very top surface of the separator's protrusions so the hydrophilic layer is left on the sidewalls and bottom surface of the separator (Fig. 2). When this top layer is removed, the edge portion of the hydrophilic layer on the sidewalls is even with the top surface of the separator. When the fuel cell is assembled and the gas distribution layer (appellant's

FDL) is set on top of the separator, this edge portion of the hydrophilic layer on the sidewall will contact the FDL, thereby making both a fluid and electrical connection. Miyazawa discusses this process in paragraphs [0035-0042].

Appellant's arguments against the Yamada reference are not pertinent since two electrically conductive porous layers are already taught by the Miyazawa reference. As discussed above, the Yamada reference teaches how to make multiple layers have different pore sizes such that the water is pulled away from the cathode.

Regarding appellant's arguments of independent claim 1, appellant argues certain elements of claimed invention are not taught by the Yamada reference. However, the rejection presented over the claimed invention is based on the teachings of Miyazawa in view of the teachings of Yamada. Elements appellant argues are not taught by the Yamada reference, such as "an impermeable electrically conductive element having lands covered by an LDM that contacts an FDL…", are already taught by the Miyazawa reference as discussed above. The Yamada reference is used to teach the sizes of the pores for the two layers. Yamada teaches using capillary action and porous materials to supply the electrodes with reactants and remove waste products (i.e., water) from the electrodes. With respect to the distinct porous layers, Yamada teaches locating two porous layers next to the cathode and the pore sizes of the layers are varied from a larger size to a smaller size in the direction the liquid is desired to travel (i.e. away from the cathode) (9:67-10:17, 10:39-59).

Applicant also argues the porosity of Yamada has little pertinence to a skilled artisan to materials outside a specialized function of the MEA. However, the function of

the MEA is to produce electricity and the porosity claimed by the instant invention is already well know in the art to the skilled artisan, as illustrated by Yamada, and therefore obvious to one of ordinary skill in the art.

Applicant's arguments regarding the materials used in the Yamada reference are not applicable to the claimed invention. Yamada's teachings to use particular materials to prevent short-circuiting the fuel cell are not commensurate in scope with the claimed invention or the teachings as presented in the rejections above. The combined teachings of Miyazawa in view of Yamada illustrates that it is known in the art to change the size of the pores of the porous material to fit the appropriate specifications required by the chosen materials of each electrode component.

Appellant argues Yamada teachings are for "materials external of any active region of the active fuel cell." First, Miyazawa already teaches using "particular porous materials inside the active regions of the fuel cell that transport gases and liquids concurrently." Second, the Yamada reference teaches a fuel cell using capillary action to supply reactants to all elements of the fuel cell and remove unwanted products, such as water, from the cathode (Abstract). Yamada teaches in figure 1, "the fuel electrode (2) and the oxidizing electrode (3) are both formed of a conductive porous material so as to permit flow there through of the fuel and oxidizing gas" (Fig.1; 15:18-22). The porous cathode and other porous layers are constructed such that the effect is "the removal of the water formed on the oxidizing electrode" (10:46-47). Each layer has a different porosity such that the pore size decreases in size in the direction the water is to travel (9:67-10:17, 10:39-59). Therefore, Yamada does teach particular pore sizes

for the porous material in the active region of the fuel cell. The limitation is rendered obvious over the teachings of Miyazawa and Yamada.

Applicant states the instant specification teaches the selection of porous materials for the components of the fuel cell relate to optimizing operational parameters of the fuel cell. However, the selection of the porous materials and the pore sizes to alter the operational parameters of the electrode are already taught by Yamada as discussed in the rejection.

Appellant argues the cited references fail to support the liquid distribution layer comprising two distinct layers.

As discussed in the above rejection of claim 12, Yamada does teach using two layers having different pore sizes to pull the water away from the cathode. By using different layers with different pore sizes, the rate at which the water is drawn from the previous layer can be varied (9:60-10:20, 10:39-60, 39:2-27). Furthermore, the separation of an integral component into separate components would be obvious to one of ordinary skill in the art at the time of the invention.

Appellant argues claim 22 is not rendered obvious by the combination of Miyazawa in view of Yamada and further in view of Davis, for the same reasons set forth above in the context of claim 1. As such, the remarks to the arguments of claim 1 are incorporated herein. Therefore, the teachings of the prior art render obvious the claimed invention of claim 22.

Appellant argues multiple times that Yamada doesn't teach an electrically conductive wicking material and only teaches a non-conductive wicking material since a

conductive material would short-circuit the fuel cell. In the Yamada reference, all passages cited by the appellant to support Yamada teaching a non-conductive wicking material is true, for that particular part of the fuel cell. In all of the cited passages, Yamada teaches placing a wicking material across the edge portion of all the electrodes, anode and cathode, in the stack so the water can be drawn away from the electrodes. If this material was conductive, the fuel cell would short out since it would be equivalent to placing a conductor across the positive and negative terminals of a battery. In a similar manner, Yamada teaches supplying the fuel cell with another wicking material that lays across all of the edge portions of the electrodes in the fuel cell stack and supplies the anode with fuel. This wicking material used to supply the fuel is not conductive for the same reason. However, Yamada's invention is drawn to creating a fuel cell that can operate using capillary action to supply the fuel and oxidant to the fuel cell and to remove the effluent (i.e., water) from the fuel cell. Using the cathode as an example, Yamada teaches forming the cathode "itself with a porous member and effect the removal of the water formed on the oxidizing electrode by the capillarity manifested by the porous member." (Yamada, 10:45-50). The electrodes are also taught to be conductive, "Here, the fuel electrode 2 and the oxidizing electrode 3 are both formed of a conductive porous material" (Yamada, 15:19-20). Yamada again teaches the conductive and porous nature of the electrodes, "the fuel electrodes (porous material of such metal as nickel) have an average pore diameter of about 30 microns. As respects the path for recovery of water, the oxidizing electrode (porous material of such a metal as nickel)" (Yamada, 39:17-21).

So, while one part of the fuel cell is taught to be non-conductive, as pointed out by appellant, when the whole reference is taken into consideration, Yamada teaches not only the appropriate times to make and use a non-conductive wicking material but also when to make and use a porous conductive wicking material. Therefore, Yamada teaches that an appropriate time to use the porous conductive wicking material is for materials in the ‘active flow field’. Furthermore, the porous conductive layers located in the 'active flow field' are already taught by Miyazawa and the Yamada reference is used to teach pore sizes, which do not depend on the conductivity of the material. The combined teachings of Miyazawa and Yamada obviate the claimed invention.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KEITH WALKER whose telephone number is (571)272-3458. The examiner can normally be reached on Mon. - Fri. 8am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Keith Walker/
Examiner, Art Unit 1795